Claims

I claim:

- 1 1. An apparatus for detecting a transmitted data symbol in an ultra-wide-
- 2 bandwidth communications system, comprising:
- a filter matched to a received reference signal and data signal
- 4 corresponding to the transmitted data symbol;
- 5 a delay block connected to an output of the filter;
- a multiplier connected to an output of the delay block and an output of
- 7 the filter;
- 8 an integrator connected to an output of the multiplier; and
- 9 decision means for selecting a largest output of the integrator to
- provide a basic building block of an ultra-wide-bandwidth the receiver to
- detect a received data symbol corresponding to the transmitted data symbol.
 - 1 2. The apparatus of claim 1, in which a conjugate block is connected at a
- 2 branch between the filter and the multiplier.
- 1 3. The apparatus of claim 1, in which the data symbol is pulse position
- 2 modulated.
- 1 4. The apparatus of claim 1, in which the data symbol is pulse amplitude
- 2 modulated.
- 1 5. The apparatus of claim 1, in which the data symbol is pulse phase
- 2 modulated.

- 1 6. The apparatus of claim 1, in which the delay block time-aligns the
- 2 reference signal with a filtered data signal.
- 7. The apparatus of claim 1, in which a plurality of data signals are
- 2 processed in parallel for each reference signal corresponding to one data
- 3 symbol.
- 8. The apparatus of claim 1, in which the data symbol is transmitted to the
- 2 receiver by on-off keying.
- 9. The apparatus of claim 1, in which the filter is matched to alternatives of
- 2 the data symbol.
- 1 10. The apparatus of claim 1, in which the filter is constructed as a matched
- 2 filter bank.
- 1 11. The apparatus of claim 1, in which the output of the multiplier is
- 2 integrated over a finite interval determined by an excess delay and signal
- 3 duration to achieve a maximum signal-to-noise ratio.
- 1 12. The apparatus of claim 1, in which a plurality of differently modulated
- 2 data signals are transmitted successively for each reference signal
- 3 corresponding to one data symbol.

- 1 13. The apparatus of claim 1, in which a plurality of basic building blocks
- 2 are interconnected by connecting the delay block to the multiplier of a
- 3 previous basic building block via the conjugate block.
- 1 14. The apparatus of claim 1, in which a plurality of basic building blocks
- 2 are interconnected by connecting the filter to the multiplier of a previous
- 3 basic building block via the conjugate block.
- 1 15. The apparatus of claim 1 further comprising:
- an equalizer connected to the output of the integrator to reduce inter-
- 3 symbol-interference.
- 1 16. A method for detecting a transmitted data symbol in an ultra-wide-
- 2 bandwidth communications system, comprising:
- 3 filtering a received reference signal and data signal;
- 4 delaying the filtered reference signal to time-align with the filtered
- 5 data signal;
- 6 multiplying the filtered data signal by the delayed reference signal to
- 7 produce a product;
- 8 integrating the product over time;
- 9 selecting a largest output of the integrator to provide a basic building
- 10 block of an ultra-wide-bandwidth the receiver to detect a received data
- symbol corresponding to the transmitted data symbol.

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